



Huntington Power Plant

6 miles west of Huntington, Utah on Hwy. 31
P.O. Box 680
Huntington, Utah 84528

January 5, 2016

Mr. Bryce Bird, Director
Utah Department of Environmental Quality
Division of Air Quality
195 North 1950 West
P.O. Box 144820
Salt Lake City, UT 84114-4820

RE: **4th Quarter, 2015 Particulate Matter Compliance Test Report - 40 CFR 63 SubPart UUUUU,**
Huntington Power Plant (Title V Permit #1501001004)

Dear Mr. Bird,

In accordance with Title V Permit Conditions II.B.2.g.1(b) (Unit 1), II.B.3.f.1(b) (Unit 2), and 40 CFR §63.10021(d) the Huntington Power Plant submits this 4th Quarter 2015 Particulate Matter (PM) Compliance Test Report. 40 CFR §63.10031(f)(6) requires the submittal of compliance test results that were generated prior to April 16, 2017. This submittal is intended to satisfy the report submittal for Huntington Units 1 and 2, and includes the portable document format (PDF) report that is submitted electronically via the Emissions Collection and Monitoring Plan System (ECMPS).

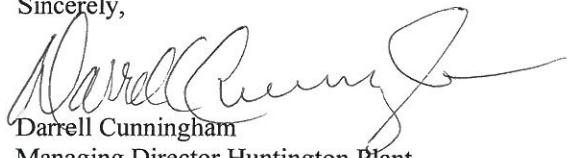
The results of the 4th Quarter 2015 PM test results are:

Unit	Emission rate (lb/mmBtu)
1	0.004
2	0.008

I am authorized to make this submission on behalf of the owners and operators of the affected source or affected units for which the submission is made. I certify under penalty of law that I have personally examined, and am familiar with, the statements and information submitted in this document and all its attachments. Based on my inquiry of those individuals with primary responsibility for obtaining the information, I certify that the statements and information are to the best of my knowledge and belief true, accurate, and complete. I am aware that there are significant penalties for submitting false statements and information, or omitting statements and information, including the possibility of fine or imprisonment.

Should you have any questions regarding this information, please contact Richard Neilson, Huntington Power Plant Environmental Engineer at (435) 687-4334 or me at (435) 687-4211.

Sincerely,



Darrell Cunningham
Managing Director Huntington Plant
Responsible Official

Enclosures: Emissions Testing Report for PacifiCorp Huntington Unit 1 – Particulate Matter Compliance Testing
Emissions Testing Report for PacifiCorp Huntington Unit 2 – Particulate Matter Compliance Testing

cc: David Barnhisel
Steve Jensen
Director, USEPA Region VIII, w/enclosures



Emissions Testing Report for PacifiCorp
Huntington Unit 2
Huntington, Utah

Particulate Matter Compliance Testing

40 CFR Part 63, Subpart UUUUU

Test Date: December 16, 2015

Project Code PC15-0001.18

Executive Summary

EMCo was contracted by PacifiCorp to conduct compliance testing at the Huntington Power Plant near Huntington, Utah. Testing was performed to determine emission rates of particulate matter (PM) from the exhaust stack of Huntington Unit 2. Compliance test results are summarized in the table below; detailed test results are given in the following report.

PacifiCorp Huntington Power Plant PM Compliance Test Results Summary						
Source	Parameter	Date	Average Value	Emission Limit		
Huntington Unit 2	Filterable Particulate Matter	12/16/2015	0.008	0.030 lb/mmBtu		
			0.08	0.30 lb/MW-hr		
Each result is the average of three two-hour test runs.						
Abbreviations: lb/mmBtu: pounds per million British thermal units lb/MW-hr: pounds per megawatt hour						

Introduction

EMCo was contracted by PacifiCorp to conduct source testing services at the Huntington Power Plant near Huntington, Utah. The Huntington Plant comprises two pulverized coal-fired boilers. Huntington Unit #2 is equipped with low-NO_x burners and overfire air for NO_x control, an FGD scrubber for SO₂ control and pulse-jet fabric filters for PM control. Testing was conducted in accordance with the requirements of 40 CFR Part 63 Subpart UUUUU, National Emission Standards for Hazardous Air Pollutants (NESHAP): Coal- and Oil-Fired Electric Utility Steam Generating Units.

Contact information for the project is listed in the table below.

Contact	Affiliation	Telephone	E-mail
Frank Zampedri Environmental Analyst	PacifiCorp	(801) 220-2169	frank.zampedri@pacificorp.com
Richard Neilson Environmental Engineer		(435) 687-4334	richard.neilson@pacificorp.com
Rob Leishman Environmental Scientist	UDEQ	(801) 536-4438	rleishman@utah.gov
Mike Corrigan Project Manager	EMCo	(801) 599-5370	mcorrigan@stacktest.us

Scope of Work

Testing was performed to determine concentrations and mass emission rates of particulate matter (PM) for comparison to the applicable emission limits listed in the table below.

Source	Regulation	Parameter	Emission Limit
Huntington Unit 2	NESHAP UUUUU	PM (lb/mmBtu)	0.030 lb/mmBtu
		PM (lb/MW-hr)	0.30 lb/MW-hr
Abbreviations: lb/mmBtu: pounds per million British thermal units lb/MW-hr: pounds per megawatt-hour			

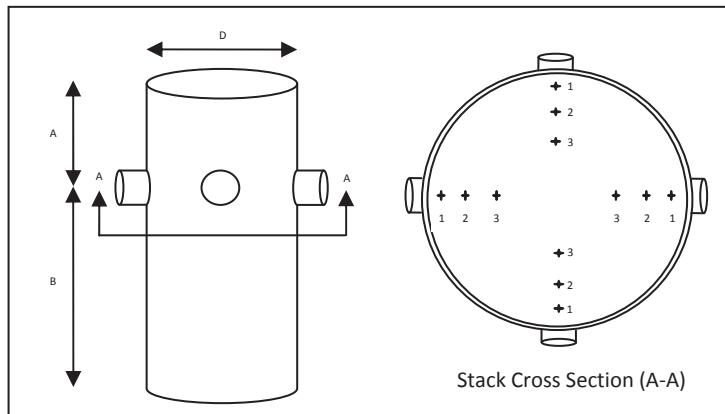
Testing Methods

EMCo used the following EPA Reference Methods for the testing program. No deviations from the Reference Methods were noted.

Parameter	EPA Reference Methods	Test Runs/Duration	Target Sample Volume
PM (lb/mmBtu)	1, 2, 3B, 4, 5*, 19	3 @ 2 hr	2 dscm (70.63 dscf)**
*In accordance with Table 5 of NESHAP Subpart UUUUU, the front-half temperature was set at 320° ± 25°F.			
**Sample volume from Table 2 of NESHAP Subpart UUUUU, doubled in accordance with §63.10005.			

Testing Location

The Huntington Unit 2 exhaust sampling location consists of a vertical, circular stack with four orthogonal sampling ports located at least six diameters downstream and two diameters upstream of the nearest flow disturbances. PM testing was performed across a grid of 12 points determined using EPA Method 1. See the schematic below.



Huntington Test Diagram	
Unit #	2
Diameter (D)	322.7"
Upstream Distance (A)	>220'
Downstream Distance (B)	>266'
Sample Point Distances from Stack Wall	
Traverse Point 1	14.1"
Traverse Point 2	47.3"
Traverse Point 3	95.5"

Test Results

The results of the testing program are given in the tables below. Detailed test results are located in Appendix A, along with sample calculations for all computed values.

PacificCorp Huntington Unit 2 PM Compliance Test Results Summary (12/16/2015)						
Parameter	Run #1	Run #2	Run #3	Average	QA Specification	Emission Limit***
Start Time	7:33	11:24	14:14	—	—	—
Stop Time	10:31	13:35	16:21	—	—	—
Sample Gas Volume (dscf)	76.73	74.34	76.13	75.73	>70.63*	—
Isokinetic Variation (%)	95.2	92.7	96.4	94.8	100 ± 10%	—
Filterable PM (lb/mmBtu)	0.011	0.007	0.007	0.008	—	0.030
Boiler Load (MW)	479	479	479	479	>459**	—
Filterable PM (lb/MW-hr)	0.11	0.07	0.07	0.08	—	0.30

* Sample volume from Table 2 of NESHAP Subpart UUUUUU, doubled in accordance with §63.10005.
**90% of design capacity, in accordance with §63.10007(a)(2).
***As shown, average PM emissions were less than 50% of the applicable emission limit, qualifying the unit for Low Emitting EGU (LEE) status.

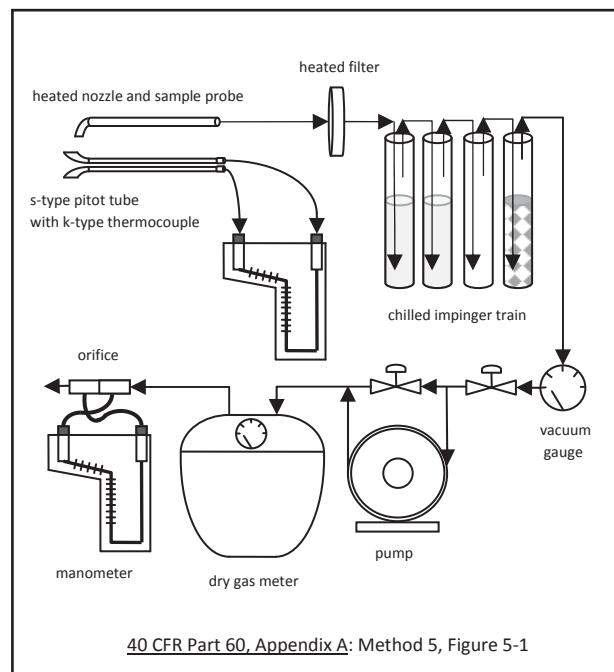
Testing Equipment

All testing equipment was housed in a climate-controlled mobile analytical laboratory designed and built by EMCo. All required quality assurance tests were performed as required by the applicable Reference Methods. Detailed equipment descriptions are given in the table below.

Parameter	Equipment	EPA Reference Method(s)
Particulate Matter (PM)	Heated probe with glass nozzle and stainless steel probe liner Quartz fiber filter S-type pitot tube K-type thermocouple Inclined-vertical manometer Dry gas meter Digital scale Analytical balance	1, 2, 3B, 4, 5B, 19

Test Details

Particulate matter testing was performed using EPA Methods 1, 2, 3B, 4 and 5. Each test run was 120 minutes in duration. Sampling was performed along a grid of points determined using EPA Method 1. Exhaust gas flow measurements were taken using an S-type pitot tube, K-type thermocouple and inclined-vertical manometer in accordance with EPA Method 2. A sample of exhaust gas was withdrawn from the stack at an isokinetic flow rate through a heated stainless steel nozzle and probe, through a heated quartz-fiber filter, through four chilled glass impingers containing known masses of water or silica gel, and through a dry gas meter. (See Figure 5-1 at right.) The default dry molecular weight for combustion sources (30 lbs/lb-mole) listed in EPA Method 3 was combined with pressure and temperature measurements to calculate stack gas velocity in accordance with EPA Method 2. Stack gas moisture concentrations were determined gravimetrically in accordance with EPA Method 4. Following each sampling period, the filter and rinses of the nozzle and probe were recovered and returned to EMCo's laboratory for gravimetric analysis. Following analysis, the particulate mass captured during each test run was combined with concurrent flow and moisture data to calculate particulate matter emissions in units of pounds per hour (lb/hr). The particulate mass captured during each test run was combined with concurrent CO₂ concentration data from the plant CEMS¹ and the appropriate fuel F-factor from EPA Method 19 (1,800 scf/mmBtu) to calculate PM emissions in units of pounds per million British thermal units (lb/mmBtu) for comparison to the applicable emission limit.



¹ EPA Method 3B §6.0 states "As an alternative to the sampling apparatus and systems described herein, other sampling systems may be used, provided such systems are ... capable of yielding acceptable results." As NESHAP UUUUUU requires certified Part 75 CEMS CO₂ data to calculate SO₂ and mercury emissions in units of lb/mmBtu, CEMS CO₂ data are considered acceptable for PM emission calculations as well.

Appended Information

Supporting data for this testing program are included as follows.

Appendix A: Test Summary

- Data Reduction Spreadsheet
- Sample Calculations

Appendix B: Field Data

- Field Datasheets

Appendix C: CEMS Data

- Test Run CEMS Printouts

Appendix D: Laboratory Data

- Gravimetric Analysis

Appendix E: Calibration Information

- Dry Gas Meter Pre-Test and Post-Test Calibrations
- Critical Orifice Calibration Certificate
- AETB Certification



Project PC15-0001.18
Appendix A: Test Summary
Data Reduction Spreadsheets
Sample Calculations

Θ	Run #	1	2	3
	Start Time	7:33	11:24	14:14
	Stop Time	10:31	13:35	16:21
Sample Time (min.)		120	120	120
EPA Method 2 Data		1	2	Average
Inputs				
D _s	Stack Diameter (inches)	322.7	322.7	322.7
P _{bar}	Barometric Pressure ("Hg)	23.6	23.6	23.6
P _g	Stack Static Pressure ("H ₂ O)	-1.2	-1.2	-1.2
C _p	Pitot Tube Coefficient (unitless)	0.84	0.84	0.84
VΔp _{avg}	Avg. Velocity Head of Stack Gas V("H ₂ O)	0.7862	0.7840	0.7722
T _s	Stack Gas Temperature (°F)	112	112	112
Calculations				
A	Stack Area (ft ²)	567.970	567.970	567.970
P _g	Stack Static Pressure ("Hg)	-0.09	-0.09	-0.09
M _d	Stack Gas Molecular Weight, dry basis (lb/lb-mole)	30.00	30.00	30.00
M _s	Stack Gas Molecular Weight, wet basis (lb/lb-mole)	28.72	28.68	28.68
P _s	Absolute Stack Pressure ("Hg)	23.51	23.51	23.51
T _{s(abs)}	Absolute Stack Gas Temperature (°R)	572	572	572
V _s	Stack Gas Velocity (ft/sec)	52.0	51.9	51.1
Q	Stack Gas Dry Volumetric Flow Rate (dscf/hr)	68,826,601	68,463,868	67,415,047
Q	Stack Gas Dry Volumetric Flow Rate (dscf/min)	1,147,110	1,141,064	1,123,584
CEMS Diluent Data		1	2	Average
CO ₂ (%vw)		11.3	11.3	11.4
CO ₂ (%vd)		12.7	12.7	12.8
EPA Method 4 Data		1	2	Average
Inputs				
V _{lc}	Volume of Water Condensed (mL)	195.4	194.7	200
V _m	Volume of Stack Gas Collected (dcf)	95.124	92.875	95.298
Y	Meter Calibration Factor (unitless)	0.9827	0.9827	0.9827
ΔH	Pressure Differential Across Orifice ("H ₂ O)	1.8	1.8	1.8
T _m	Temperature at Gas Meter (°F)	50	54	55
Calculations				
P _m	Absolute Pressure at Gas Meter ("Hg)	23.73	23.73	23.73
T _m	Absolute Temperature at Gas Meter (°R)	510	514	515
V _{wc(std)}	Volume of Water Condensed (scf)	9.20	9.16	9.41
V _{m(std)}	Sample Gas Volume (dscf)	76.73	74.34	76.13
B _{ws act}	Observed Stack Gas Moisture Content (%/100)	0.107	0.110	0.110
B _{ws sat}	Saturated Moisture Content (%/100)	0.117	0.117	0.117
B _{ws}	Moisture Content Used (%/100)	0.107	0.110	0.110
EPA Method 5 Data		1	2	Average
Inputs				
D _n	Nozzle diameter (")	0.247	0.247	0.247
C1	Mass of PM collected on filter (mg)	11.7	5.3	6.3
C2	Mass of PM collected in rinses (mg)	14.0	10.7	10.2
Emission Calculations				
F _c	Fuel F-Factor (scf/mmBtu)	1800	1800	1800
A _n	Cross-sectional area of nozzle (ft ²)	3.33E-04	3.33E-04	3.33E-04
I	Isokinetic variation (%)	95.2	92.7	96.4
m _n	Total Filterable PM mass less blank (mg)	25.7	16.0	16.5
C _s	Filterable Particulate concentration (gr/dscf)	0.005	0.003	0.003
C _s	Filterable Particulate concentration (lb/dscf)	7.38E-07	4.75E-07	4.78E-07
E _{lb/hr}	Filterable Particulate mass emission rate (lb/hr)	51	32	32
	Boiler Load (MW)	479	479	479
	Filterable Particulate mass emission rate (lb/MW-hr)	0.11	0.07	0.07
F _c	Filterable Particulate mass emission rate (lb/mmBtu)	0.011	0.007	0.007
8760 hrs/yr	Filterable Particulate mass emission rate (tons/year)	223	142	141

EPA Method 5: Determination of Particulate Matter Emissions (40 CFR Part 60, Appendix A-1)

Variables

Variable	Value	Definition	Unit of Measurement
D _s	322.7	Stack Diameter	inches
A	567.97	Cross-Sectional Area of the Stack	ft ²
P _g	-1.20	Stack Static Pressure	in. H ₂ O
P _g	-0.09	Stack Static Pressure	in. Hg
%CO ₂	12.7	Concentration of Carbon Dioxide	Dry Volume Percent (%vd)
M _d	30.00	Dry Molecular Weight of the Stack Gas (default)	lb/lb-mole
P _{bar}	23.60	Barometric Pressure	in. Hg
ΔH	1.80	Pressure Differential across Orifice	in. H ₂ O
P _m	23.73	Absolute Pressure at Gas Meter	in.Hg
t _m	50	Temperature at Gas Meter	°F
T _m	510	Absolute Temperature at Gas Meter	°R
K1	0.04706	Conversion Factor	ft ³ /mL
V _{lc}	195.4	Volume of Water Condensed	g
V _{wc(std)}	9.20	Volume of Water Condensed	scf
K ₄	17.64	Constant	°R/in.Hg
Y	0.9827	Meter Calibration Factor	Unitless
V _m	95.124	Volume of Stack Gas Collected	dcf
V _{m(std)}	76.733	Sample Gas Volume	dscf
B _{ws}	0.107	Stack Gas Moisture Content	%/100
M _s	28.72	Actual Molecular Weight of the Stack Gas	lb/lb-mole
P _s	23.51	Absolute Stack Pressure	in. Hg
T _s	112	Average Stack Temperature	°F
T _{s(abs)}	572	Average Absolute Stack Temperature	°R
K _p	85.49	Conversion Factor	(ft/sec) x V(((lb/lb-mole)(in.Hg))/((°R)(in.H ₂ O)))
C _p	0.84	Pitot Coefficient	Dimensionless
AvgVΔp	0.7862	Average Square Root of Velocity Head Readings	in. H ₂ O
V _s	51.97	Average Stack Gas Velocity	ft/sec
T _{std}	528	Standard Absolute Temperature	°R
P _{std}	29.92	Standard Absolute Pressure	in. Hg
Q	68,826,601	Dry Volumetric Flow Rate Corrected to Standard Conditions	dscf/hr
D _n	0.247	Nozzle Diameter	inches
A _n	3.33E-04	Cross-Sectional Area of the Nozzle	ft ²
m _n	25.70	Total PM Mass	mg
C _s	7.38E-07	Particulate Concentration	lb/dscf
E _{lb/hr}	50.8	PM Mass Emission Rate	pounds per hour
F _c	1800	F-Factor from EPA Method 19	scf/mmBtu
E _{lb/mmBtu}	0.011	PM Mass Emission Rate	pounds per million Btu
E _{tons/yr}	222.6	PM Mass Emission Rate	tons per year
K5	0.0945	Constant	(in.Hg · min) / (°R · sec)
Θ	120	Sample Time	minutes
I	95.2 %	Isokinetic variation	percent

EPA Method 5: Determination of Particulate Matter Emissions (40 CFR Part 60, Appendix A-1)

$$A = \pi(D_s/24)^2$$

$$\pi(322.7/24)^2$$

$$= 567.97 \text{ ft}^2$$

$$P_g = P_{bar}/13.6$$

$$= -1.2/13.6$$

$$= -0.09 \text{ in. Hg}$$

$$M_d = 30.00 \text{ lb/lb-mole}$$

$$P_m = P_{bar} + (\Delta H/13.6)$$

$$= 23.6 + (1.8/13.6)$$

$$= 23.73 \text{ in. Hg}$$

$$T_m = 460 + t_m$$

$$= 460 + 50$$

$$= 510 \text{ R}$$

$$V_{wc(std)} = K_1 \times V_{lc}$$

$$= 0.04706 \times 195.4$$

$$= 9.20 \text{ scf} \quad (Eq. 4-1)$$

$$V_{m(std)} = \frac{K_4 \times Y \times V_m \times P_m}{T_m}$$

$$= \frac{17.64 \times 0.9827 \times 95.124 \times 23.73}{510}$$

$$= 76.73 \text{ dscf} \quad (Eq. 4-3)$$

$$B_{ws} = \frac{V_{wc(std)}}{V_{wc(std)} + V_{m(std)}}$$

$$= \frac{9.20}{9.20 + 76.73}$$

$$= 0.107 (\%/100) \quad (Eq. 4-4)$$

$$M_s = M_d \times (1 - B_{ws}) + (18.0 \times B_{ws})$$

$$= 30.00 \times (1 - 0.107) + (18.0 \times 0.107)$$

$$= 28.72 \text{ lb/lb-mole} \quad (Eq. 2-6)$$

$$P_s = P_{bar} + P_g$$

$$= 23.6 + (-0.09)$$

$$= 23.51 \text{ in. Hg}$$

$$T_{s(abs)} = 460 + T_s$$

$$= 460 + 112$$

$$= 572 \text{ R}$$

EPA Method 5: Determination of Particulate Matter Emissions (40 CFR Part 60, Appendix A-1)

$$V_s = K_p \times C_p \times Avgv/\Delta p \times \sqrt{\frac{T_{s(abs)}}{(P_s \times M_s)}}$$

$$= 85.49 \times 0.84 \times 0.7862 \times \sqrt{\frac{572}{(23.51 \times 28.72)}}$$

$$= 52.0 \text{ ft/sec}$$

(Eq. 2-7)

$$Q = 3600 \times (1 - B_{ws}) \times (V_s) \times (A) \times \frac{(T_{std} \times P_s)}{(T_{s(abs)} \times P_{std})}$$

$$= 3600 \times (1 - 0.107) \times (51.97) \times (567.97) \times \frac{(528 \times 23.51)}{(572 \times 29.92)}$$

$$= 68,826,601 \text{ dscf/hr}$$

(Eq. 2-8)

$$A_n = \pi(D_n/24)^2$$

$$\pi(0.247/24)^2$$

$$= 3.33E-04 \text{ ft}^2$$

$$C_s = \frac{m_n}{(mg/g)(g/lb)(V_{m(std)})}$$

$$= \frac{25.7}{(1000)(453.592)(76.733)}$$

$$= 7.38E-07 \text{ lb/dscf}$$

$$E_{lb/hr} = C_s \times Q$$

$$= 7.38E-07 \times 68826601$$

$$= 50.8 \text{ lb/hr}$$

$$E_{lb/mmBtu} = \frac{C_s \times F_c \times 100}{(CO_2\%vd)}$$

$$= \frac{7.38E-07 \times 1800 \times 100}{(12.7)}$$

$$= 0.011 \text{ lb/mmBtu}$$

$$E_{tons/yr} = \frac{E_{lb/hr} \times (\text{Hrs/yr})}{(\text{lbs/ton})}$$

$$= \frac{50.82 \times 8,760}{2000}$$

$$= 222.6 \text{ tons/year}$$

$$I = \frac{K5 \times T_{s(abs)} \times V_{m(std)} \times 100}{P_{s(abs)} \times V_s \times A_n \times \Theta \times (1 - B_{ws})}$$

$$= \frac{0.0945 \times 572 \times 76.733 \times 100}{23.51 \times 51.97 \times 3.3E-04 \times 120 \times (1 - 0.107)}$$

$$= 95.2 \%$$

(Eq. 5-7)



Project PC15-0001.18
Appendix B: Field Data
Field Datasheets

Emissions Measurement Company: Method 5 Data Sheet

EMCo Job #:	PC 15-01	Operator(s):	WS, M3
Client:	Pacificoff	Barometric pressure ("Hg):	23.6
Source:	Huntington 2	Static pressure ("H ₂ O):	-1.2 0.020 20.1
Date:	12/16/15	Leak Check ("H ₂ O @ Vac):	0.000 0.000
Run #	1	Leak Check ("H ₂ O @ Vac):	0.000 0.15
Meterbox ID:	M5-2	Pitot ID / Coeff:	0.89
Meterbox Y =	98.1	Pitot Leak Check:	
O ₂ %:	6	Nozzle Diameter:	0.247
CO ₂ %:	12.3	K Factor:	2.92
Start Time	733	Stop Time	1031

Impinger Weights (x.g)	Initial	Final
Impinger 1		
Impinger 2		
Impinger 3		
Impinger 4 (SG)		
Total	758.6	954.0
Total	(195.4)	

Filter ID: 832
Tin ID: 1334

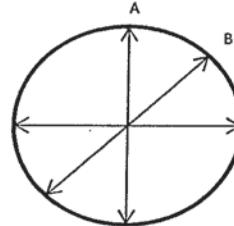
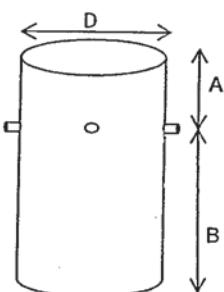
Traverse Point	Sample Time	Stack Temp (°F)	Probe Temp (°F)	Filter Temp (°F)	Velocity ΔP ("H ₂ O)	Orifice Pressure ΔH ("H ₂ O)	Vacuum ("Hg)	Sample Volume (ft ³)	DGM Temp (°F) Inlet	DGM Temp (°F) Outlet	Imp. Outlet Temp (°F)
L1	10	112	300	320	0.55	1.6	9	388.660			
L2	20	112	301	321	0.62	1.8	10	404.5	45	42	38
L3	30	112	303	319	0.71	2.0	11	412.4	46	43	40
J1	40	112	300	320	0.55	1.6	9	420.4	47	45	43
J2	50	111	301	319	0.61	1.8	10	428.3	52	46	52
J3	60	112	305	319	0.70	2.0	11	437.4	54	47	66
Z1	10	111	306	320	0.54	1.6	10	444.8	55	49	58
Z2	80	112	305	320	0.60	1.8	16	451.5	56	50	57
Z3	90	112	301	320	0.71	2.0	11	461.3	57	50	56
Y1	100	112	303	320	0.52	1.5	9	469.2	57	50	50
Y2	111	112	305	320	0.62	1.8	10	477.8	57	50	51
Y3	120	112	302	320	0.71	2.0	11	483.784	58	51	51
12	120	(112)	300	319	(0.7862)	(1.792)	11	95.124	48(50)	50	66
Total	Total	Average	Minimum	Minimum	Avg ΔP	Average	Max.	Total	Average	Maximum	

Stack Schematic

Stack Diameter (D)=

Distance A=

Distance B=



Nozzle Calibration

A = .247

B = .247

C = .247

Average = .247

Max Difference = 0

(Must be < 0.004 in.)

Emissions Measurement Company: Method 5 Data Sheet

EMCo Job #:	PC 15-01	Operator(s):	WS, MC
Client:	Pacifwear	Barometric pressure ("Hg):	28.6
Source:	Huntington 2	Static pressure ("H ₂ O):	2.2
Date:	7/2/15	Leak Check ("H ₂ O @ Vac):	0.00 P15'
Run #	2	Leak Check ("H ₂ O @ Vac):	0.00 P20"
Meterbox ID:	115-2	Pitot ID / Coeff:	0.84 ✓
Meterbox Y =	1821	ΔH@= 1.79	Pitot Leak Check: ✓
O ₂ %:	12.2	Nozzle Diameter:	0.247
CO ₂ %:	12.2	K Factor:	0.92
Start Time	1124	Stop Time	1335

Impinger Weights (x.x g)	Initial	Final
Impinger 1		
Impinger 2		
Impinger 3		
Impinger 4 (SG)		
Total	757.7	752.4
Total	(194.7)	

Filter ID: 836
Tin ID: 1339

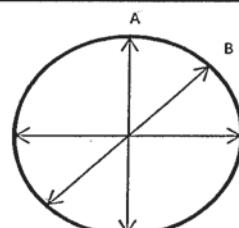
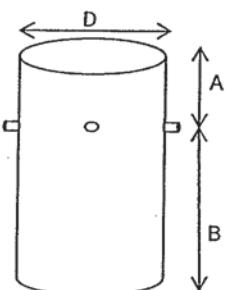
Traverse Point	Sample Time	Stack Temp (°F)	Probe Temp (°F)	Filter Temp (°F)	Velocity ΔP ("H ₂ O)	Orifice Pressure ΔH ("H ₂ O)	Vacuum ("Hg)	Sample Volume (ft ³)	DGM Temp (°F) Inlet	DGM Temp (°F) Outlet	Imp. Outlet Temp (°F)
								485.258			
1-1	10	112	306	322	0.54	1.5	11	492.9	55	51	36
1-2	20	111	305	320	0.61	1.9	12	500.6	55	51	38
1-3	30	112	307	319	0.70	2.0	12	508.3	55	51	40
2-1	40	112	300	321	0.55	1.5	11	516.0	56	52	45
2-2	50	111	306	320	0.62	1.8	12	523.1	57	52	49
2-3	60	112	310	322	0.10	2.0	14	531.4	57	53	52
3-1	70	112	308	319	0.52	1.5	13	539.1	57	53	52
3-2	80	112	301	320	0.61	1.8	13	547.8	57	53	51
3-3	90	112	302	320	0.71	2.0	14	555.3	55	53	51
4-1	100	112	300	319	0.53	1.5	12	562.8	55	53	48
4-2	110	112	301	319	0.60	1.9	12	570.6	55	53	49
4-3	120	112	303	320	0.71	2.0	13	578.133	55	53	49
12	120	(112)	300	319	0.7840	1.51.167	14	92.875	54	52	
Total	Total	Average	Minimum	Minimum	Avg VΔP	Average	Max.	Total	Average	Maximum	

Stack Schematic

Stack Diameter (D)=

Distance A=

Distance B=



Nozzle Calibration

(A=)
(B=)
(C=)
(Average =)
(Max Difference =)
(Must be < 0.004 in.)

Emissions Measurement Company: Method 5 Data Sheet

EMCo Job #:	PC 15-01	Operator(s):	WS, MC
Client:	paufinor	Barometric pressure ("Hg):	23.6
Source:	Huntington	Static pressure ("H ₂ O):	-1.2
Date:	12/16/15	Leak Check ("H ₂ O @ Vac):	0.00 @ 20"
Run #	3	Leak Check ("H ₂ O @ Vac):	0.00 @ 20"
Meterbox ID:	M5-3	Pitot ID / Coeff:	0.84
Meterbox Y =	14807 ΔH@= 1.79	Pitot Leak Check:	✓
O ₂ %:	6	Nozzle Diameter:	0.247
CO ₂ %:	12.2	K Factor:	2.92
Start Time	14:14	Stop Time	1621

Impinger Weights (x.x g)	Initial	Final
Impinger 1		
Impinger 2		
Impinger 3		
Impinger 4 (SG)		
Total	768.8	968.8
Total	845	800.0
Filter ID:		
Tin ID:		

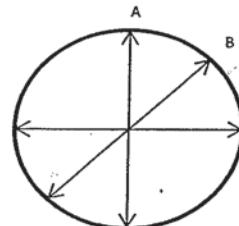
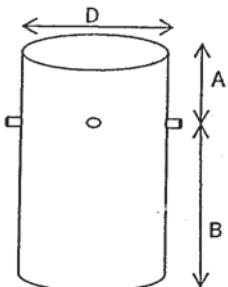
Traverse Point	Sample Time	Stack Temp (°F)	Probe Temp (°F)	Filter Temp (°F)	Velocity Δp ("H ₂ O)	Orifice Pressure ΔH ("H ₂ O)	Vacuum ("Hg)	Sample Volume (ft ³)	DGM Temp (°F) Inlet	DGM Temp (°F) Outlet	Imp. Outlet Temp (°F)
								578.376			
1 1	10	111	308	321	.48	1.4	9	586.8	53	52	35
2	20	112	304	320	.61	1.8	12	595.4	54	52	40
3	30	111	303	321	.69	2.0	13	602.1	55	53	46
2 1	40	112	304	320	.50	1.5	10	610.9	56	53	46
2	50	112	300	319	.60	1.8	12	617.9	56	53	50
3	60	112	301	319	.70	2.0	13	625.7	56	53	50
3 1	70	111	305	323	.49	1.4	9	633.8	56	53	49
2	80	112	300	319	.61	1.8	12	640.0	57	54	54
3.	90	112	301	320	.71	2.0	13	647.7	57	54	49
4 1	100	112	302	320	.51	1.5	10	655.2	57	54	49
2	110	112	301	321	.60	1.8	12	665.6	57	54	49
3	120	112	300	322	.69	2.0	13	673.674	57	54	49
1 2	120	(112)	300	319	(0.71722)	(1.150)	13	(95.298)	(55)		50
Total	Total	Average	Minimum	Minimum	Avg. Δp	Average	Max.	Total	Average		Maximum

Stack Schematic

Stack Diameter (D)=

Distance A=

Distance B=



Nozzle Calibration

A=

B=

C=

Average =

Max Difference =

(Must be < 0.004 in.)



Project PC15-0001.18
Appendix C: Lab Data
Gravimetric Analysis

Project Code:	PC15-1.18
Date Finalized:	12/29/2015
Analyst:	Parks

Laboratory Results Summary	
Sample ID	Filterable Particulate Matter (mg)
Huntington 2, Run #1	25.7
Huntington 2, Run #2	16.0
Huntington 2, Run #3	16.5
No blank corrections were performed.	

Analytical Narrative

Quartz fiber filters were dessicated and tared to a constant weight in the EMCo laboratory prior to sampling. Following testing, the filters were dessicated for at least 24 hours, then weighed to a constant weight (± 0.5 mg). The acetone rinses were measured to the nearest milliliter, transferred to tared aluminum weighing dishes, taken to dryness under a fume hood, then weighed to a constant weight (± 0.5 mg). Each result above represents total filterable particulate matter for each test run (acetone rinse + filter catch), with no blank correction performed unless otherwise indicated.

Instrumentation

All measurements were taken using a Torbal Model AGCN200 Analytical Balance under laboratory conditions. The instrument is auto-calibrated and challenged with three NIST-traceable reference weights daily.

Detection Limit / Sensitivity

All measurements are recorded to 0.0001g (0.1mg).

Notes

No deviations from the analytical procedure from EPA Method 5 were noted. All samples were received in good condition. After analysis, all samples are archived for a period of one year.

Attachments

Gravimetric Analysis Logs

Sample Chain of Custody



EPA Method 5 Gravimetric Analysis Log

Project Code:

PC15-1.18

Unit ID:

Huntington 2

Front-Half Particulate Matter Filter Catch

Filter #	Run #1		Run #2		Run #3	
	Date	Weight (g)	Date	Weight (g)	Date	Weight (g)
Final Weight (g)	12/29/15	0.3671	12/29/15	0.3604	12/29/15	0.3636
Tare Weight (g)	2/26/15	0.3554	2/26/15	0.3551	2/26/15	0.3573
Filter Catch (g)		0.0117		0.0053		0.0063

Front-Half Particulate Matter Acetone Rinse Catch

Dish #	Run #1		Run #2		Run #3		Blank	
	Date	Weight (g)						
Final Weight (g)	12/29/15	6.3625	12/29/15	6.4189	12/29/15	6.3771	12/29/15	6.3647
Tare Weight (g)	9/30/15	6.3485	9/30/15	6.4082	9/30/15	6.3669	9/30/15	6.3650
Total Rinse Catch (g)		0.0140		0.0107		0.0102		-0.0003

Total Particulate Catch

	Run #1	Run #2	Run #3
Filter Catch (g)	0.0117	0.0053	0.0063
+ Rinse Catch (g)	0.0140	0.0107	0.0102
- Acetone Blank (g)	0.0000	0.0000	0.0000
Total PM (g)	0.0257	0.0160	0.0165

Laboratory Chain of Custody Record

Project Code:	PC 15-01		
Client:	Pacificorp		
Facility:	Huntington 182		
Unit:	182		
Sample Date(s):	12/15-16/15		
Project Manager:	Mike Corrigan		
Sample ID / Run #	Filter ID	Tin ID	Notes
U2 R1	832	1334	
12/16/15 R2	836	1339	
" R3	845	1340	
U1 R1	738	1337	
12/15/15 R2	734	1338	
" R3	737	1333	
A Blank		1336	
Relinquished by:	Mike Corrigan M		Date: 12/16/15
Received by:	MP		Date 12/17



Project PC15-0001.18
Appendix D: CEMS Data
CEMS Printouts for Test Runs

Average Data

Plant: HUNTINGTON PLANT

Interval: 1 Minute

Type: Block

Report Period: 12/16/2015 07:33 Through 12/16/2015 10:31

Time Online Criteria: 1 minute(s)

Source	Parameter Unit	UNIT2				
		BARPRESS (INHG)	CO2 (PCT)	OPACITY (PCT)	STKTEMP (DEGF)	UNITLOAD (MW)
12/16/15	07:33	23.616	11.1	1.7	107.44	481
12/16/15	07:34	23.615	11.2	1.8	107.42	481
12/16/15	07:35	23.615	11.2	1.6	107.34	480
12/16/15	07:36	23.615	11.1	1.5	107.63	478
12/16/15	07:37	23.615	11.1	1.4	107.73	477
12/16/15	07:38	23.615	11.1	1.4	107.45	477
12/16/15	07:39	23.616	11.1	1.4	107.13	478
12/16/15	07:40	23.616	11.1	1.4	106.78	479
12/16/15	07:41	23.616	11.2	1.5	106.55	479
12/16/15	07:42	23.616	11.2	1.7	106.84	478
12/16/15	07:43	23.616	11.1	1.4	107.01	478
12/16/15	07:44	23.616	11.1	1.4	107.04	478
12/16/15	07:45	23.617	11.1	1.4	106.87	478
12/16/15	07:46	23.617	11.1	1.4	107.14	478
12/16/15	07:47	23.618	11.1	1.3	107.04	477
12/16/15	07:48	23.618	11.1	1.3	106.55	477
12/16/15	07:49	23.618	11.1	1.4	106.77	479
12/16/15	07:50	23.619	11.1	1.5	106.35	481
12/16/15	07:51	23.618	11.2	1.5	105.66	483
12/16/15	07:52	23.618	11.2 IM	1.5	104.68	483
12/16/15	07:53	23.618	11.2 IM	1.6	100.89	483
12/16/15	07:54	23.619	7.6 IM	1.7	99.64	482
12/16/15	07:55	23.619	0.7 IM	1.6	98.77	480
12/16/15	07:56	23.619	0.1 IM	1.5	98.91	479
12/16/15	07:57	23.620	0.0 IM	1.6	98.61	478
12/16/15	07:58	23.620	0.0 IM	1.6	99.00	478
12/16/15	07:59	23.621	0.0 IM	1.5	98.67	478
12/16/15	08:00	23.621	2.6 IM	1.6	98.04	478
12/16/15	08:01	23.621	10.4 IM	1.6	97.38	477
12/16/15	08:02	23.620	10.9 IM	1.5	96.25	477
12/16/15	08:03	23.620	11.0 IM	1.5	96.60	477
12/16/15	08:04	23.620	10.7 IM	1.4	96.59	478
12/16/15	08:05	23.620	5.0 IM	1.4	96.67	478
12/16/15	08:06	23.620	6.9 IM	1.5	97.12	479
12/16/15	08:07	23.620	5.1 IM	1.4	98.07	478
12/16/15	08:08	23.621	5.1 IM	1.4	103.56	478
12/16/15	08:09	23.621	5.1 IM	1.4	103.79	478
12/16/15	08:10	23.621	5.1 IM	1.4	104.12	479
12/16/15	08:11	23.621	6.7 IM	1.4	104.19	481
12/16/15	08:12	23.620	16.5 IM	1.7	103.90	482
12/16/15	08:13	23.620	18.2 IM	1.6	104.13	482
12/16/15	08:14	23.620	18.2 IM	1.5	104.27	481
12/16/15	08:15	23.619	18.2 IM	1.5	104.47	480
12/16/15	08:16	23.620	17.9 IM	1.5	104.50	480
12/16/15	08:17	23.619	13.4 IM	1.4	104.58	482
12/16/15	08:18	23.619	11.6 IM	1.4	104.68	482
12/16/15	08:19	23.619	11.4 IM	1.5	104.46	479
12/16/15	08:20	23.618	11.4	1.5	104.61	477
12/16/15	08:21	23.618	11.3	1.4	104.76	475

C = Calibration

S = Substituted

* = Suspect

U = Startup

Report Version 4.0

HTNDAHS

F = Unit Offline

E = Exceedance

M = Maintenance

T = Out Of Control

Report Generated 12/16/2015 15:16 Huntington 2 Q4 PM

Page 19 of 33

Average Data

Plant: HUNTINGTON PLANT

Interval: 1 Minute

Type: Block

Report Period: 12/16/2015 07:33 Through 12/16/2015 10:31

Time Online Criteria: 1 minute(s)

12/16/15	08:22	23.618	11.3	1.5	104.95	474
12/16/15	08:23	23.618	11.3	1.6	105.19	474
12/16/15	08:24	23.618	11.3	1.6	105.13	475
12/16/15	08:25	23.617	11.3	1.6	104.55	478
12/16/15	08:26	23.617	11.5	1.8	104.53	482
12/16/15	08:27	23.617	11.5	1.8	104.87	486
12/16/15	08:28	23.617	11.5	1.8	104.58	486
12/16/15	08:29	23.616	11.6	1.8	104.35	484
12/16/15	08:30	23.617	11.5	1.9	104.79	484
12/16/15	08:31	23.617	11.4	1.7	105.36	484
12/16/15	08:32	23.617	11.4	1.6	105.36	482
12/16/15	08:33	23.617	11.4	1.6	105.41	481
12/16/15	08:34	23.617	11.4	1.7	105.42	480
12/16/15	08:35	23.618	11.5	1.6	105.34	480
12/16/15	08:36	23.619	11.4	1.4	105.51	480
12/16/15	08:37	23.619	11.3	1.4	105.90	478
12/16/15	08:38	23.619	11.3	1.5	105.74	476
12/16/15	08:39	23.619	11.3	1.3	105.92	476
12/16/15	08:40	23.619	11.2	1.2	106.25	475
12/16/15	08:41	23.619	11.2	1.3	105.88	474
12/16/15	08:42	23.619	11.2	1.2	105.60	474
12/16/15	08:43	23.620	11.3	1.2	105.35	474
12/16/15	08:44	23.620	11.2	1.3	105.29	474
12/16/15	08:45	23.621	11.3	1.3	105.37	475
12/16/15	08:46	23.621	11.3 IC	1.4	105.40	476
12/16/15	08:47	23.621	12.7 IC	1.4	105.20	477
12/16/15	08:48	23.621	5.5 IC	1.3	104.97	478
12/16/15	08:49	23.621	0.2 IC	1.3	105.17	479
12/16/15	08:50	23.621	0.1 IC	1.3	103.72	480
12/16/15	08:51	23.621	0.1 IC	1.3	99.74	481
12/16/15	08:52	23.621	0.0 IC	1.3	98.90	482
12/16/15	08:53	23.621	0.0 IC	1.4	98.24	481
12/16/15	08:54	23.621	0.0 IC	1.3	97.91	480
12/16/15	08:55	23.621	0.0 IC	1.3	98.13	480
12/16/15	08:56	23.622	0.0 IC	1.3	98.13	479
12/16/15	08:57	23.622	0.0 IC	1.3	97.73	477
12/16/15	08:58	23.622	0.0 IC	1.4	97.52	479
12/16/15	08:59	23.622	0.0 IC	1.5	96.60	481
12/16/15	09:00	23.622	0.4 IC	1.9	96.39	482
12/16/15	09:01	23.622	7.2 IC	2.1	96.60	483
12/16/15	09:02	23.622	10.9 IC	2.0	96.48	482
12/16/15	09:03	23.622	11.0 IC	2.0	96.29	483
12/16/15	09:04	23.622	11.0 IC	1.8	96.85	483
12/16/15	09:05	23.622	11.0 IC	1.7	98.05	482
12/16/15	09:06	23.622	11.0 IC	1.6	102.37	480
12/16/15	09:07	23.621	11.1 IC	1.6	104.24	478
12/16/15	09:08	23.621	11.2 IC	1.4	105.29	477
12/16/15	09:09	23.622	11.2 IC	1.5	105.93	476
12/16/15	09:10	23.621	11.2 IC	1.6	105.66	475
12/16/15	09:11	23.621	11.3 IC	1.7	104.99	476
12/16/15	09:12	23.621	11.3	1.5	105.35	477
12/16/15	09:13	23.621	11.3	1.5	105.94	478

F = Unit Offline

E = Exceedance

M = Maintenance

T = Out Of Control

C = Calibration

S = Substituted

* = Suspect

U = Startup

Report Version 4.0

HTNDAHS

Average Data

Plant: HUNTINGTON PLANT

Interval: 1 Minute

Type: Block

Report Period: 12/16/2015 07:33 Through 12/16/2015 10:31

Time Online Criteria: 1 minute(s)

12/16/15	09:14	23.622	11.3	1.5	105.73	480
12/16/15	09:15	23.623	11.4	1.4	105.33	479
12/16/15	09:16	23.624	11.4	1.5	105.47	479
12/16/15	09:17	23.624	11.3	1.5	105.73	481
12/16/15	09:18	23.624	11.4	1.4	105.83	480
12/16/15	09:19	23.624	11.4	1.7	106.10	480
12/16/15	09:20	23.624	11.3	1.4	106.39	479
12/16/15	09:21	23.624	11.3	1.3	106.13	480
12/16/15	09:22	23.624	11.3	1.3	106.17	479
12/16/15	09:23	23.624	11.4	1.2	106.26	479
12/16/15	09:24	23.624	11.4	1.2	106.50	481
12/16/15	09:25	23.624	11.3	1.2	106.85	480
12/16/15	09:26	23.624	11.3	1.2	106.77	480
12/16/15	09:27	23.625	11.3	1.2	106.34	480
12/16/15	09:28	23.625	11.3	1.2	106.02	479
12/16/15	09:29	23.624	11.3	1.2	106.08	477
12/16/15	09:30	23.624	11.3	1.2	105.91	477
12/16/15	09:31	23.624	11.3 IC	1.2	106.07	476
12/16/15	09:32	23.624	11.3 IC	1.4	106.31	478
12/16/15	09:33	23.624	8.7 IC	1.4	106.20	479
12/16/15	09:34	23.623	5.2 IC	1.3	105.99	479
12/16/15	09:35	23.623	5.1 IC	1.3	105.88	478
12/16/15	09:36	23.623	5.1 IC	1.6	106.11	478
12/16/15	09:37	23.623	5.1 IC	1.5	106.24	479
12/16/15	09:38	23.623	6.4 IC	1.4	105.94	480
12/16/15	09:39	23.624	10.5 IC	1.4	105.47	481
12/16/15	09:40	23.624	11.0 IC	1.4	105.35	482
12/16/15	09:41	23.624	11.0 IC	1.4	105.51	481
12/16/15	09:42	23.625	11.0 IC	1.4	105.74	481
12/16/15	09:43	23.627	14.2 IC	1.3	105.76	481
12/16/15	09:44	23.627	18.1 IC	1.4	106.06	480
12/16/15	09:45	23.628	18.2 IC	1.2	106.58	479
12/16/15	09:46	23.628	18.2 IC	1.2	106.46	478
12/16/15	09:47	23.628	18.2 IC	1.2	106.14	476
12/16/15	09:48	23.628	15.1 IC	1.1	104.63	476
12/16/15	09:49	23.628	11.6 IC	1.2	101.21	474

F = Unit Offline

E = Exceedance

M = Maintenance

T = Out Of Control

Report Generated 12/16/2015 15:16 Huntington 2 Q4 PM

C = Calibration

S = Substituted

* = Suspect

U = Startup

Report Version 4.0

HTNDAHS

Average Data

Plant: HUNTINGTON PLANT

Interval: 1 Minute

Type: Block

Report Period: 12/16/2015 07:33 Through 12/16/2015 10:31

Time Online Criteria: 1 minute(s)

12/16/15	09:50	23.628	11.4 IC	1.3	100.23	476
12/16/15	09:51	23.629	11.4 IC	1.1	99.54	477
12/16/15	09:52	23.629	11.4 IC	1.5	98.96	477
12/16/15	09:53	23.629	11.4 IC	1.3	99.12	477
12/16/15	09:54	23.629	11.5	1.2	98.98	477
12/16/15	09:55	23.629	11.4	1.2	98.81	478
12/16/15	09:56	23.628	11.4	1.2	99.07	479
12/16/15	09:57	23.628	11.5	1.3	98.77	480
12/16/15	09:58	23.628	11.5	1.3	98.19	480
12/16/15	09:59	23.628	11.4	1.3	97.77	479
12/16/15	10:00	23.627	11.5	1.3	97.40	479
12/16/15	10:01	23.627	11.5	1.2	97.65	480
12/16/15	10:02	23.627	11.4	1.3	98.30	480
12/16/15	10:03	23.627	11.4 IC	1.4	98.87	480
12/16/15	10:04	23.627	12.2 IC	1.4	104.15	482
12/16/15	10:05	23.627	8.2 IC	1.5	104.78	482
12/16/15	10:06	23.628	5.1 IC	1.4	105.06	481
12/16/15	10:07	23.628	5.1 IC	1.5	105.70	482
12/16/15	10:08	23.628	5.1 IC	1.7	106.57	480
12/16/15	10:09	23.629	5.1 IC	1.5	106.92	479
12/16/15	10:10	23.629	7.8 IC	1.6	106.55	478
12/16/15	10:11	23.630	11.0 IC	1.5	106.18	477
12/16/15	10:12	23.631	11.0 IC	1.4	106.43	476
12/16/15	10:13	23.631	11.0 IC	1.4	106.81	476
12/16/15	10:14	23.631	11.2 IC	1.3	106.88	475
12/16/15	10:15	23.631	15.5 IC	1.3	106.90	475
12/16/15	10:16	23.632	18.2 IC	1.4	106.94	477
12/16/15	10:17	23.632	18.2 IC	1.4	106.57	478
12/16/15	10:18	23.633	18.3 IC	1.5	106.26	478
12/16/15	10:19	23.634	18.1 IC	1.4	106.49	478
12/16/15	10:20	23.633	13.8 IC	1.4	106.67	479
12/16/15	10:21	23.634	11.6 IC	1.4	106.38	481
12/16/15	10:22	23.634	11.5 IC	1.3	106.53	482
12/16/15	10:23	23.635	11.4 IC	1.3	107.02	481
12/16/15	10:24	23.635	11.4 IC	1.3	106.70	480
12/16/15	10:25	23.635	11.4	1.3	106.32	480
12/16/15	10:26	23.635	11.4	1.3	106.70	479
12/16/15	10:27	23.635	11.4	1.4	106.69	480
12/16/15	10:28	23.634	11.4	1.3	106.37	479
12/16/15	10:29	23.633	11.3	1.2	106.98	479
12/16/15	10:30	23.633	11.3	1.2	107.38	478
12/16/15	10:31	23.632	11.4 IC	1.2	106.73	478

Average	23.623	11.3	1.4	103.89	479
Minimum	23.615	11.1	1.1	96.25	474
Maximum	23.635	11.6	2.1	107.73	486
Summation	4,228.506	893.3	257.1	18,595.66	85,739

Included Data Points	179	79	179	179	179
Total number of Data Points	179	179	179	179	179

C = Calibration

S = Substituted

* = Suspect

U = Startup

Report Version 4.0

HTNDAHS

F = Unit Offline

E = Exceedance

M = Maintenance

T = Out Of Control

Report Generated 12/16/2015 15:16 Huntington 2 Q4 PM

Average Data

Plant: HUNTINGTON PLANT

Interval: 1 Minute

Type: Block

Report Period: 12/16/2015 11:24 Through 12/16/2015 13:35

Time Online Criteria: 1 minute(s)

Source Parameter Unit	UNIT2				
	BARPRESS (INHG)	CO2 (PCT)	OPACITY (PCT)	STKTEMP (DEGF)	UNITLOAD (MW)
12/16/15 11:24	23.624	11.4 IC	1.6	109.14	484
12/16/15 11:25	23.624	11.3 IC	1.5	109.48	483
12/16/15 11:26	23.624	11.3 IC	1.5	109.52	481
12/16/15 11:27	23.623	11.3	1.5	109.43	480
12/16/15 11:28	23.623	11.3	1.5	109.13	479
12/16/15 11:29	23.622	11.2	1.3	108.86	477
12/16/15 11:30	23.622	11.2	1.3	109.28	476
12/16/15 11:31	23.622	11.1	1.3	109.88	475
12/16/15 11:32	23.622	11.1	1.4	109.62	474
12/16/15 11:33	23.621	11.2	1.3	108.59	475
12/16/15 11:34	23.621	11.2	1.3	108.31	475
12/16/15 11:35	23.620	11.2	1.4	108.37	477
12/16/15 11:36	23.620	11.2	1.5	108.16	478
12/16/15 11:37	23.620	11.3	1.3	107.59	478
12/16/15 11:38	23.620	11.3	1.7	107.63	479
12/16/15 11:39	23.621	11.3	1.4	107.77	479
12/16/15 11:40	23.620	11.3	1.3	107.79	480
12/16/15 11:41	23.620	11.2	1.3	107.71	480
12/16/15 11:42	23.620	11.2	1.4	107.44	481
12/16/15 11:43	23.620	11.3	1.4	107.04	481
12/16/15 11:44	23.619	11.3	1.4	106.58	480
12/16/15 11:45	23.619	11.3	1.4	101.88	479
12/16/15 11:46	23.618	11.3	1.4	100.73	480
12/16/15 11:47	23.618	11.3	1.4	100.41	480
12/16/15 11:48	23.618	11.3	1.5	100.13	481
12/16/15 11:49	23.618	11.4	1.6	100.42	481
12/16/15 11:50	23.618	11.4	1.6	99.70	482
12/16/15 11:51	23.617	11.4	1.6	99.86	482
12/16/15 11:52	23.616	11.4	1.7	99.75	482
12/16/15 11:53	23.615	11.5	1.9	98.82	483
12/16/15 11:54	23.615	11.5	1.8	98.13	484
12/16/15 11:55	23.613	11.4	1.7	98.19	485
12/16/15 11:56	23.612	11.4	1.5	98.47	484
12/16/15 11:57	23.612	11.4	1.5	98.49	483
12/16/15 11:58	23.612	11.4	1.5	98.53	481
12/16/15 11:59	23.611	11.4	1.4	100.53	480
12/16/15 12:00	23.610	11.3	1.4	104.88	480
12/16/15 12:01	23.609	11.3	1.4	105.43	479
12/16/15 12:02	23.608	11.3	1.5	105.46	478
12/16/15 12:03	23.608	11.3	1.4	106.18	478
12/16/15 12:04	23.608	10.9 I	1.3	106.29	478
12/16/15 12:05	23.608	5.2 I	1.4	106.71	478
12/16/15 12:06	23.607	10.0 I	1.3	106.99	479
12/16/15 12:07	23.607	11.3 I	1.3	106.17	478
12/16/15 12:08	23.607	11.3 I	1.3	106.54	477
12/16/15 12:09	23.607	11.2 I	1.5	106.98	476
12/16/15 12:10	23.607	11.2	1.2	107.18	476
12/16/15 12:11	23.607	11.2	1.2	107.09	476
12/16/15 12:12	23.607	11.2	1.2	106.90	476

C = Calibration

S = Substituted

* = Suspect

U = Startup

Report Version 4.0

HTNDAHS

F = Unit Offline

E = Exceedance

M = Maintenance

T = Out Of Control

Report Generated 12/16/2015 15:19 Huntington 2 Q4 PM

Page 23 of 33

Average Data

Plant: HUNTINGTON PLANT

Interval: 1 Minute

Type: Block

Report Period: 12/16/2015 11:24 Through 12/16/2015 13:35

Time Online Criteria: 1 minute(s)

12/16/15	12:13	23.607	11.2	1.2	106.78	476
12/16/15	12:14	23.607	11.3	1.2	106.58	476
12/16/15	12:15	23.607	11.2	1.2	106.72	478
12/16/15	12:16	23.606	11.3	1.3	106.95	478
12/16/15	12:17	23.606	11.3	1.5	106.63	481
12/16/15	12:18	23.605	11.4	1.6	106.34	483
12/16/15	12:19	23.604	11.4	1.5	106.76	482
12/16/15	12:20	23.604	11.4	1.6	107.16	483
12/16/15	12:21	23.604	11.3	1.6	106.80	482
12/16/15	12:22	23.604	11.4	1.6	106.77	482
12/16/15	12:23	23.604	11.3	1.6	106.98	481
12/16/15	12:24	23.604	11.3	1.6	106.86	483
12/16/15	12:25	23.604	11.3	1.8	106.69	483
12/16/15	12:26	23.604	11.3	1.5	106.68	483
12/16/15	12:27	23.603	11.3	1.6	106.96	482
12/16/15	12:28	23.603	11.3	1.5	107.06	481
12/16/15	12:29	23.602	11.2	1.4	107.25	480
12/16/15	12:30	23.602	11.1	1.4	107.60	478
12/16/15	12:31	23.601	11.1	1.4	107.51	476
12/16/15	12:32	23.600	11.1	1.4	107.19	477
12/16/15	12:33	23.599	11.2	1.4	106.91	476
12/16/15	12:34	23.599	11.2	1.3	106.83	478
12/16/15	12:35	23.599	11.1	1.3	107.35	476
12/16/15	12:36	23.599	11.1	1.3	107.59	474
12/16/15	12:37	23.600	11.1	1.2	107.33	474
12/16/15	12:38	23.600	11.1	1.3	107.35	474
12/16/15	12:39	23.599	11.1	1.3	107.59	475
12/16/15	12:40	23.599	11.2	1.2	107.78	476
12/16/15	12:41	23.598	11.1	1.5	107.44	477
12/16/15	12:42	23.598	11.2	1.2	105.70	478
12/16/15	12:43	23.597	11.2	1.1	102.09	478
12/16/15	12:44	23.596	11.3	1.1	100.46	478
12/16/15	12:45	23.596	11.3	1.1	99.77	478
12/16/15	12:46	23.596	11.3	1.2	99.45	479
12/16/15	12:47	23.596	11.3	1.3	99.46	480
12/16/15	12:48	23.595	11.4	1.3	99.55	479
12/16/15	12:49	23.595	11.4	1.3	99.73	480
12/16/15	12:50	23.595	11.3	1.2	100.07	479
12/16/15	12:51	23.595	11.2	1.2	99.96	477
12/16/15	12:52	23.595	11.3	1.1	99.35	477
12/16/15	12:53	23.594	11.2	1.2	98.95	477

F = Unit Offline

E = Exceedance

M = Maintenance

T = Out Of Control

Report Generated 12/16/2015 15:19 Huntington 2 Q4 PM

C = Calibration

S = Substituted

* = Suspect

U = Startup

Report Version 4.0

HTNDAHS

Average Data

Plant: HUNTINGTON PLANT

Interval: 1 Minute

Type: Block

Report Period: 12/16/2015 11:24 Through 12/16/2015 13:35

Time Online Criteria: 1 minute(s)

12/16/15	12:54	23.594	11.2	1.2	98.79	476
12/16/15	12:55	23.594	11.3	1.3	98.71	476
12/16/15	12:56	23.593	11.3	1.3	99.05	476
12/16/15	12:57	23.593	11.3	1.5	100.08	478
12/16/15	12:58	23.593	11.4	1.4	104.72	478
12/16/15	12:59	23.593	11.2	1.3	105.82	479
12/16/15	13:00	23.594	11.1	1.5	105.82	479
12/16/15	13:01	23.594	11.3	1.4	105.91	479
12/16/15	13:02	23.593	11.2	1.5	106.23	479
12/16/15	13:03	23.592	11.2	1.5	106.25	479
12/16/15	13:04	23.590	11.3	1.5	106.17	480
12/16/15	13:05	23.590	11.2	1.4	106.53	480
12/16/15	13:06	23.589	11.2	1.4	106.65	480
12/16/15	13:07	23.589	11.2	1.3	106.53	480
12/16/15	13:08	23.588	11.2	1.3	106.83	480
12/16/15	13:09	23.588	11.2	1.3	106.89	480
12/16/15	13:10	23.588	11.3	1.3	106.82	480
12/16/15	13:11	23.588	11.2	1.2	107.02	479
12/16/15	13:12	23.588	11.2	1.5	107.14	479
12/16/15	13:13	23.588	11.2	1.2	107.29	477
12/16/15	13:14	23.588	11.1	1.1	107.63	475
12/16/15	13:15	23.588	11.1	1.0	107.72	474
12/16/15	13:16	23.587	11.0	1.1	107.92	475
12/16/15	13:17	23.586	11.1	1.1	107.88	476
12/16/15	13:18	23.586	11.1	1.2	107.65	478
12/16/15	13:19	23.586	11.2	1.2	107.29	479
12/16/15	13:20	23.586	11.2	1.2	107.16	479
12/16/15	13:21	23.586	11.2	1.3	107.20	479
12/16/15	13:22	23.586	11.2	1.2	106.96	478
12/16/15	13:23	23.586	11.2	1.2	107.03	479
12/16/15	13:24	23.586	11.2	1.2	107.48	480
12/16/15	13:25	23.586	11.2	1.2	107.58	481
12/16/15	13:26	23.586	11.2	1.3	107.74	481
12/16/15	13:27	23.586	11.3	1.2	107.71	481
12/16/15	13:28	23.585	11.3	1.2	107.69	479
12/16/15	13:29	23.585	11.2	1.3	107.71	479
12/16/15	13:30	23.585	11.2	1.2	107.69	478
12/16/15	13:31	23.584	11.2	1.2	107.59	478
12/16/15	13:32	23.584	11.2	1.3	107.42	481
12/16/15	13:33	23.584	11.3	1.3	107.34	482
12/16/15	13:34	23.584	11.3	1.5	107.09	482
12/16/15	13:35	23.584	11.3	1.6	106.95	480

Average	23.602	11.3	1.4	105.51	479
Minimum	23.584	11.0	1.0	98.13	474
Maximum	23.624	11.5	1.9	109.88	485
Summation	3,115.504	1,383.9	180.5	13,926.82	63,221

Included Data Points	132	123	132	132	132
Total number of Data Points	132	132	132	132	132

C = Calibration

S = Substituted

* = Suspect

U = Startup

Report Version 4.0

HTNDAHS

F = Unit Offline

E = Exceedance

M = Maintenance

T = Out Of Control

Report Generated 12/16/2015 15:19 Huntington 2 Q4 PM

Page 25 of 33

Average Data

Plant: HUNTINGTON PLANT

Interval: 1 Minute

Type: Block

Report Period: 12/16/2015 14:14 Through 12/16/2015 16:21

Time Online Criteria: 1 minute(s)

Source Parameter Unit	UNIT2				
	BARPRESS (INHG)	CO2 (PCT)	OPACITY (PCT)	STKTEMP (DEGF)	UNITLOAD (MW)
12/16/15 14:14	23.579	11.3	1.6	109.51	478
12/16/15 14:15	23.579	11.4	1.5	108.93	477
12/16/15 14:16	23.579	11.4	1.5	108.86	477
12/16/15 14:17	23.579	11.3	1.5	109.07	478
12/16/15 14:18	23.579	11.3	1.5	109.19	479
12/16/15 14:19	23.579	11.4	1.5	109.16	479
12/16/15 14:20	23.579	11.3	1.5	109.15	479
12/16/15 14:21	23.579	11.3	1.5	108.99	477
12/16/15 14:22	23.580	11.4	1.5	108.79	478
12/16/15 14:23	23.580	11.4	1.7	108.47	479
12/16/15 14:24	23.580	11.4	1.9	108.18	481
12/16/15 14:25	23.580	11.4	1.8	108.07	484
12/16/15 14:26	23.580	11.5	1.8	107.96	485
12/16/15 14:27	23.580	11.4	1.8	108.25	484
12/16/15 14:28	23.581	11.4	1.7	108.37	483
12/16/15 14:29	23.581	11.4	1.7	108.30	481
12/16/15 14:30	23.581	11.5	1.7	107.98	481
12/16/15 14:31	23.581	11.4	1.6	107.96	481
12/16/15 14:32	23.581	11.3	1.6	108.43	481
12/16/15 14:33	23.581	11.4	1.5	108.44	479
12/16/15 14:34	23.580	11.4	1.5	107.83	479
12/16/15 14:35	23.580	11.4	1.5	107.80	477
12/16/15 14:36	23.580	11.3	1.4	108.13	477
12/16/15 14:37	23.580	11.3	1.3	108.18	477
12/16/15 14:38	23.580	11.3	1.3	106.35	475
12/16/15 14:39	23.580	11.2	1.6	103.48	475
12/16/15 14:40	23.581	11.3	1.4	102.56	474
12/16/15 14:41	23.581	11.4	1.4	101.00	476
12/16/15 14:42	23.582	11.4	1.5	100.03	476
12/16/15 14:43	23.582	11.5	1.5	100.07	476
12/16/15 14:44	23.582	11.5	1.5	100.00	478
12/16/15 14:45	23.582	11.5	1.4	100.36	480
12/16/15 14:46	23.582	11.4	1.4	100.89	482
12/16/15 14:47	23.583	11.5	1.5	99.95	484
12/16/15 14:48	23.583	11.6	1.5	98.25	486
12/16/15 14:49	23.583	11.7	1.5	97.61	485
12/16/15 14:50	23.583	11.6	1.5	98.46	486
12/16/15 14:51	23.583	11.6	1.4	98.95	487
12/16/15 14:52	23.583	11.6	1.4	98.88	486
12/16/15 14:53	23.583	11.6	1.4	100.75	482
12/16/15 14:54	23.582	11.5	1.3	106.01	479
12/16/15 14:55	23.582	11.4	1.3	106.62	476
12/16/15 14:56	23.582	11.3	1.4	106.98	475
12/16/15 14:57	23.581	11.2	1.4	107.24	474
12/16/15 14:58	23.580	11.3	1.3	107.35	474

C = Calibration

S = Substituted

* = Suspect

U = Startup

Report Version 4.0

HTNDAHS

F = Unit Offline

E = Exceedance

M = Maintenance

T = Out Of Control

Report Generated: 12/29/15 15:19 Huntington 2 Q4 PM

Page 26 of 33

Average Data

Plant: HUNTINGTON PLANT

Interval: 1 Minute

Type: Block

Report Period: 12/16/2015 14:14 Through 12/16/2015 16:21

Time Online Criteria: 1 minute(s)

12/16/15	14:59	23.580	11.3	1.5	107.23	474
12/16/15	15:00	23.579	11.3	1.3	106.97	475
12/16/15	15:01	23.579	11.3	1.3	107.01	475
12/16/15	15:02	23.579	11.3	1.3	107.15	476
12/16/15	15:03	23.578	11.3	1.3	107.32	476
12/16/15	15:04	23.577	11.4	1.4	107.00	477
12/16/15	15:05	23.577	11.4	1.4	106.49	478
12/16/15	15:06	23.576	11.4	1.3	106.46	479
12/16/15	15:07	23.575	11.4	1.4	106.86	480
12/16/15	15:08	23.574	11.3	1.4	107.13	480
12/16/15	15:09	23.574	11.4	1.4	106.79	480
12/16/15	15:10	23.574	11.4	1.4	106.38	480
12/16/15	15:11	23.574	11.4	1.4	106.79	480
12/16/15	15:12	23.574	11.4	1.4	107.42	480
12/16/15	15:13	23.574	11.4	1.4	107.25	480
12/16/15	15:14	23.573	11.4	1.5	106.82	480
12/16/15	15:15	23.573	11.4	1.3	106.80	480
12/16/15	15:16	23.574	11.4	1.2	106.91	480
12/16/15	15:17	23.574	11.4	1.2	107.08	479
12/16/15	15:18	23.575	11.3	1.3	107.01	477
12/16/15	15:19	23.574	11.3	1.2	107.26	477
12/16/15	15:20	23.574	11.2	1.2	107.74	477
12/16/15	15:21	23.575	11.3	1.3	107.60	477
12/16/15	15:22	23.574	11.3	1.4	107.27	477
12/16/15	15:23	23.575	11.3	1.4	107.41	478
12/16/15	15:24	23.575	11.3	1.4	107.47	477
12/16/15	15:25	23.575	11.4	1.3	107.04	478
12/16/15	15:26	23.574	11.4	1.3	106.91	479
12/16/15	15:27	23.573	11.3	1.3	107.11	478
12/16/15	15:28	23.573	11.3	1.3	107.34	478
12/16/15	15:29	23.573	11.3	1.5	107.49	477
12/16/15	15:30	23.573	11.4	1.5	107.40	478
12/16/15	15:31	23.573	11.3	1.4	107.33	478
12/16/15	15:32	23.572	11.2	1.4	107.47	478
12/16/15	15:33	23.571	11.3	1.4	107.41	477
12/16/15	15:34	23.571	11.3	1.4	107.31	477
12/16/15	15:35	23.570	11.4	1.5	107.12	478
12/16/15	15:36	23.569	11.4	1.4	106.54	479
12/16/15	15:37	23.569	11.4	1.2	103.55	479
12/16/15	15:38	23.569	11.4	1.4	101.20	480
12/16/15	15:39	23.570	11.4	1.4	99.99	480
12/16/15	15:40	23.571	11.5	1.6	99.20	481
12/16/15	15:41	23.571	11.5	1.6	99.16	482
12/16/15	15:42	23.571	11.6	1.5	99.22	482
12/16/15	15:43	23.572	11.5	1.5	99.75	483

F = Unit Offline

E = Exceedance

M = Maintenance

T = Out Of Control

Report Generated 12/29/15 15:19 Huntington 2 Q4 PM

C = Calibration

S = Substituted

* = Suspect

U = Startup

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Average Data

Plant: HUNTINGTON PLANT

Interval: 1 Minute

Type: Block

Report Period: 12/16/2015 14:14 Through 12/16/2015 16:21

Time Online Criteria: 1 minute(s)

12/16/15	15:44	23.572	11.5	1.6	100.47	484
12/16/15	15:45	23.571	11.4	1.7	100.02	484
12/16/15	15:46	23.571	11.5	1.7	99.18	484
12/16/15	15:47	23.572	11.6	1.5	98.48	482
12/16/15	15:48	23.572	11.5	1.4	98.72	481
12/16/15	15:49	23.572	11.4	1.4	98.91	479
12/16/15	15:50	23.572	11.4	1.4	98.88	477
12/16/15	15:51	23.572	11.4	1.5	100.45	477
12/16/15	15:52	23.572	11.4	1.4	105.16	476
12/16/15	15:53	23.572	11.4	1.3	105.63	476
12/16/15	15:54	23.572	11.3	1.4	106.24	475
12/16/15	15:55	23.571	11.3	1.5	106.76	475
12/16/15	15:56	23.571	11.3	1.4	106.96	475
12/16/15	15:57	23.571	11.3	1.3	107.24	475
12/16/15	15:58	23.571	11.3	1.4	107.27	475
12/16/15	15:59	23.571	11.3	1.5	106.99	476
12/16/15	16:00	23.572	11.4	1.5	106.69	477
12/16/15	16:01	23.572	11.4	1.5	107.04	478
12/16/15	16:02	23.572	11.3	1.5	107.35	478
12/16/15	16:03	23.572	11.3	1.5	107.30	477
12/16/15	16:04	23.572	11.4 I	1.6	107.49	479
12/16/15	16:05	23.572	5.8 I	1.6	107.39	480
12/16/15	16:06	23.572	10.0 I	1.5	107.45	480
12/16/15	16:07	23.571	11.4 I	1.6	107.64	481
12/16/15	16:08	23.571	11.4 I	1.6	107.63	481
12/16/15	16:09	23.571	11.4 I	1.5	107.42	480
12/16/15	16:10	23.571	11.4	1.5	107.18	480
12/16/15	16:11	23.572	11.4	1.4	107.28	481
12/16/15	16:12	23.572	11.4	1.4	107.38	482
12/16/15	16:13	23.572	11.4	1.3	107.38	482
12/16/15	16:14	23.573	11.4	1.3	107.82	482
12/16/15	16:15	23.573	11.3	1.4	108.17	480
12/16/15	16:16	23.573	11.4	1.4	107.97	479
12/16/15	16:17	23.574	11.3	1.4	107.63	478
12/16/15	16:18	23.575	11.4	1.4	107.62	477
12/16/15	16:19	23.576	11.3	1.3	107.97	476
12/16/15	16:20	23.577	11.3	1.6	108.10	476
12/16/15	16:21	23.577	11.3	1.5	107.83	477

Average	23.576	11.4	1.5	105.71	479
Minimum	23.569	11.2	1.2	97.61	474
Maximum	23.583	11.7	1.9	109.51	487
Summation	3,017.705	1,388.7	185.6	13,531.04	61,300

Included Data Points	128	122	128	128	128
Total number of Data Points	128	128	128	128	128

C = Calibration

S = Substituted

* = Suspect

U = Startup

Report Version 4.0

HTNDAHS

F = Unit Offline

E = Exceedance

M = Maintenance

T = Out Of Control

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Project PC15-0001.18

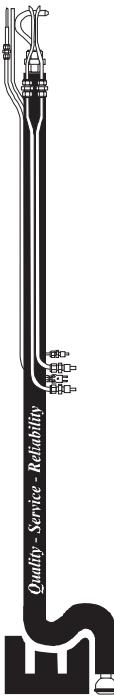
Appendix E: Calibration Information

Dry Gas Meter Pre-Test and Post-Test Calibrations

Critical Orifice Calibration Certificate

AETB Certification

METHOD 5 DRY GAS METER CALIBRATION USING CRITICAL ORIFICES



- 1) Select three critical orifices to calibrate the dry gas meter which bracket the expected operating range.
- 2) Record barometric pressure before and after calibration procedure.
- 3) Run at tested vacuum (from Orifice Calibration Report), for a period of time necessary to achieve a minimum total volume of 5 cubic feet.
- 4) Record data and information in the **GREEN** cells, **YELLOW** cells are calculated.

HTG-U2PM-Q4-2015-1: Huntington 2 Q4 PM

METER #:		METER SERIAL #:		CRITICAL ORIFICE SET SERIAL #:		BAROMETRIC PRESSURE (in Hg):		INITIAL		FINAL		AVG (P _{bar})									
ORIFICE #	RUN #	K'	TESTED VACUUM (in Hg)	DGM READINGS (F° ³)	INITIAL	FINAL	NET (V _m)	AMBIENT	DGM INLET	DGM OUTLET	DGM AVG	ELAPSED TIME (MIN)	DGM ΔH (in H ₂ O)	(1)	(2)	(3)	Y	Average Y	Y % Diff to other orifices	Y % Diff with other orifices	ΔH @
23	1	0.6363	16.5	234.775	243.154	8.379	75	77	78	76	76	76.75	10.00	1.8	6.8310	6.7858	0.993	1.79			
	2	0.6363	16.5	243.154	251.561	8.407	75	78	78	76	76	77	10.00	1.8	6.8507	6.7858	0.991	1.72			
	3	0.6363	16.5	251.561	260.816	9.255	75	78	79	76	77	77.5	11.00	1.8	7.5347	7.4644	0.991	1.79			
18	1	0.5004	17.5	260.816	267.502	6.686	75	78	79	77	78	78	10.00	1.1	5.4269	5.3365	0.983	1.76			
	2	0.5004	17.5	267.502	274.173	6.671	75	78	78	77	77	77.5	10.00	1.1	5.4197	5.3365	0.985	1.77			
	3	0.5004	17.5	274.173	281.527	7.354	75	78	78	77	77	77.5	11.00	1.1	5.3746	5.8702	0.983	1.77			
16	1	0.4381	18	281.527	287.454	5.927	75	78	79	77	78	78	10.00	0.87	4.8075	4.6721	0.972	1.82			
	2	0.4381	18	287.454	293.340	5.886	75	79	80	78	79	79	10.00	0.87	4.7654	4.6721	0.980	1.82			
	3	0.4381	18	293.340	299.310	5.970	75	79	80	78	79	79	10.00	0.87	4.8334	4.6721	0.967	1.82			
AVG = 0.973																					

USING THE CRITICAL ORIFICES AS CALIBRATION STANDARDS:

The following equations are used to calculate the standard volumes of air passed through the DGM, V_m (std), and the critical orifice, V_σ (std), and the DGM calibration factor, K . These equations are automatically calculated in the spreadsheet above.

$$\text{AVERAGE DRY GAS METER CALIBRATION FACTOR, } Y = \frac{0.9827}{\text{AVERAGE } \Delta H @ = 1.79}$$

$$(1) \quad Vm_{(std)} = K_1 * Vm * \frac{Pbar + (\Delta H / 13.6)}{Tm} \quad = \text{Net volume of gas sample passed through the DGM, corrected to standard conditions}$$

$$K_1 = 17.64 \text{ °Rin. Hg (English), 0.3858 K/mm Hg (Metric)}$$

$$T_m = \text{Absolute DGM avg. temperature (F - English, °K - Metric)}$$

$$K' = \text{Average K factor from Critical Orifice Calibration}$$

$$(2) \quad Vcr_{(std)} = K' * \frac{Pbar * \Theta}{\sqrt{Tamb}} \quad = \text{Volume of gas sample passed through the critical orifice, corrected to standard conditions}$$

$$T_{amb} = \text{Absolute ambient temperature (F - English, °K - Metric)}$$

$$Y = \frac{Vcr_{(std)}}{Vm_{(std)}} \quad = \text{DGM calibration factor}$$

$$\Delta H @ = \left(\frac{0.75 \cdot \theta}{V_{cr}(\text{std})} \right)^2 \Delta H \left(\frac{V_m(\text{std})}{V_m} \right)$$

METHOD 5 DRY GAS METER CALIBRATION USING CRITICAL ORIFICES



EMCO

EMISSIONS MEASUREMENT COMPANY

ENVIRONMENTAL SUPPLY COMPANY

DATE: 12/22/2015		METER SERIAL #: 15550542	BAROMETRIC PRESSURE (in Hg): 23.8		FINAL AVG (P _{bar}) 23.8
METER ID #: M5-2		CRITICAL ORIFICE SET SERIAL #: 17215/15315			

ORIFICE #	RUN #	K [*]	TESTED VACUUM (in Hg)	DGM READINGS (FT ³)		AMBIENT DGM INLET NET (V _n)	DGM OUTLET INITIAL FINAL	DGM AVG	ELAPSED TIME (MIN) θ	DGM ΔH (in H ₂ O)	(1) V _c (STD)	(2) Y	(3) Y % Diff to Average Y	Y % Diff with other orifices	ΔH@			
				INITIAL	FINAL													
18	1	0.5004	18	677.954	681.223	3.269	55	50	49	49	49.5	5.00	1.1	2.7045	2.6248	0.971	1.86	
	2	0.5004	18	681.223	684.489	3.266	55	50	49	49	49.5	5.00	1.1	2.7020	2.6248	0.971	1.86	
	3	0.5004	18	684.489	687.750	3.261	55	50	49	49	49.5	5.00	1.1	2.6979	2.6248	0.973	1.86	
25	1	0.6637	16	687.750	692.068	4.318	55	52	52	50	50	51	5.00	1.8	3.5695	3.4813	0.975	1.73
	2	0.6637	16	692.068	696.395	4.317	55	54	54	52	52	53	5.00	1.8	3.5548	3.4813	0.979	1.72
17	1	0.4524	18	696.385	699.344	2.959	55	54	54	52	52	53	5.00	0.88	2.4297	2.3730	0.977	0.59
	2	0.4524	18	699.344	702.290	2.946	55	55	55	53	53	54	5.00	0.88	2.4143	2.3730	0.983	0.59

USING THE CRITICAL ORIFICES AS CALIBRATION STANDARDS:

The following equations are used to calculate the standard volumes of air passed through the DGM, V_c(std), and the critical orifice, V_c(std), and the DGM calibration factor, Y. These equations are automatically calculated in the spreadsheet above.

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = **0.9762**

INITIAL DRY GAS METER CALIBRATION FACTOR, Y = **0.9827**

% DIFFERENCE = **0.66%** (**Must be <5%**)

AVERAGE ΔH@ = **1.80**

$$\Delta H@ = \left(\frac{0.75 \cdot \theta}{V_{c\text{(std)}}} \right)^2 \Delta H \left(\frac{V_m\text{(std)}}{V_m} \right)$$

K₁ = 17.64 °R/in. Hg (English), 0.3858 %/mm Hg (Metric)

T_m = Absolute DGM avg. temperature (°R - English, °K - Metric)

T_{amb} = Absolute ambient temperature (°R - English, °K - Metric)

K = Average K factor from Critical Orifice Calibration

$$(1) \quad Vm_{(std)} = K_1 * Vm * \frac{Pbar + (\Delta H / 13.6)}{Tm}$$

$$(2) \quad Vc'_{(std)} = K^* * \frac{Pbar * \Theta}{\sqrt{Tm}}$$

$$(3) \quad Y = \frac{Vc'_{(std)}}{Vm_{(std)}}$$

= DGM calibration factor

40 CFR Part 60, Appendix A-1 Method 2 §10.3: Temperature Sensors. After each field use, calibrate thermocouples at a temperature within 10% of the average absolute stack temperature. A reference thermocouple and potentiometer (calibrated against NIST standards) may be used. The absolute temperature measured with the sensor being calibrated and the reference sensor must agree within 1.5%.

Pre-calibration Procedure

- Check max vacuum (21-22 1/2 "Hg), leak check. Use WD-40 if necessary.
- Check pump oil fill level and pump knockout. Make sure there is extra pump oil
- Check gauge oil on manometer. Add oil if necessary. Check for spare oil in back of meter.
- Wipe interior and exterior of meter clean with wet rag/soap.
- Check for missing or loose screws on meter box, pump housing and manometer.
- Proceed to meter and thermocouple calibration.
- Initial here upon completion **PF**

Thermocouple Calibration using NIST-Traceable PIE Model 520 Calibrator

Reference Value: **250**

Console Value: **251**

Percent Difference: **0.4%**

Acceptance Criteria: ±1.5%

Practical Instrument Electronics	S/N 107078
Tel: (860) 972-2600 • Fax: (860) 972-2638	
CERTIFICATE OF CALIBRATION	
This is to certify that your instrument has been calibrated using standards whose accuracies are traceable to the National Institute of Standards and Technology (formerly NBS) within the limits of the NIST Calibration Services. Actual records pertaining to these standards are on file and are available for examination.	
Certified By: Practical Instrument Electronics	
Recommended Recalibration: Annually	
Model Number: 520-K	Serial No. S/N 107078
Calibration Date: 02-03-09	In Service Date: _____
Calibration Due _____	

METHOD 5 CRITICAL ORIFICE CALIBRATION

CRITICAL ORIFICE SET S/N: 1531s



REFERENCE DRY GAS METER

SERIAL NUMBER: 544840

CALIBRATION FACTOR, Yc: 0.997

DATE: 3/23/2009

LEAK CHECK: Good

ORIFICE #	RUN #	CRITICAL VACUUM (in Hg)	TESTED VACUUM (in Hg)	Barometric Pressure per Orifice AVG (P _{bar})		DGM READINGS (F°)		TEMPERATURES °F		DGM ΔH (in H ₂ O)	K' FACTOR (english)	K' FACTOR (metric/liters)	K' FACTOR (metric-m ³)	K' VARIATION (%)
				INITIAL	FINAL	DGM INLET NET (V _l)	AMBIENT	DGM INLET FINAL	DGM OUTLET INITIAL					
31	1	15	16	330.316	336.911	6.595	66.0	67.0	67.0	68.0	68.0	67.50	6.00	4.97
31	2	15	16	336.911	343.513	6.602	66.0	67.0	67.0	68.0	68.0	67.50	6.00	4.97
23	1	15	18	343.715	349.502	5.787	66.0	67.0	67.0	68.0	68.0	67.50	7.00	2.73
23	2	15	18	349.502	355.284	5.782	66.0	67.0	67.0	68.0	68.0	67.50	7.00	2.73
18	1	15	18	355.535	360.750	5.215	66.0	67.0	67.0	68.0	68.0	67.50	8.00	1.70
18	2	15	18	360.750	365.958	5.208	66.0	67.0	67.0	68.0	68.0	67.50	8.00	1.70
16	1	15	18	366.614	372.329	5.715	66.0	67.0	67.0	68.0	68.0	67.50	10.00	1.28
16	2	15	18	372.329	378.036	5.707	66.0	67.0	68.0	68.0	68.0	67.75	10.00	1.28
12	1	15	18	378.412	383.415	5.003	67.0	67.0	68.0	68.0	68.0	67.75	12.00	0.64
12	2	15	18	383.415	388.418	5.003	66.0	68.0	68.0	68.0	68.0	68.00	12.00	0.64

USING THE CRITICAL ORIFICES AS CALIBRATION STANDARDS:

Calculate the standard volumes of air passed through the DGM and the critical orifices, and calculate the DGM calibration factor, Y, using the equations in US EPA Method 5, Section 7.2.3 (these equations are programmed on the spreadsheet included with each orifice set).

Critical Orifice Set number 1531s Was calibrated in accordance with the Code of Federal Regulations, Title 40, Part 60, Appendix A, Method 5, Section 7.2

K' = Critical orifice coefficient,

$[(ft^3)(^{\circ}R)^{1/2})]/[(in.Hg)(min.)]$ - English Units

$[(liters)(^{\circ}K)^{1/2})]/[(mm Hg)(min.)]$ - Metric-Liters Units

$[(m^3)(^{\circ}K)^{1/2})]/[(mm Hg)(min.)]$ - Metric Units

03/23/09
Date
Signature

RE: Certification of Air Emission Testing Body (AETB) Conformance

To Whom it May Concern:

This letter is to confirm that Emissions Measurement Company LLC ("EMCo") is an Air Emission Testing Body (AETB) operating in conformance with ASTM D7036-04, as required by 40 CFR Part 75, Appendix A §6.1.2. The table below lists the EPA Reference Methods for which each listed Project Manager is a Qualified Individual and other relevant information required by (as applicable) 40 CFR Part 75.59(a)(15), 40 CFR Part 75.59(b)(6) and 40 CFR Part 75.59(d)(4).

Emissions Measurement Company (800) 984-9883					
AETB Qualified Individual Information					
QI Name	QI Email	Exam*	Exam Date	Exam Provider	Provider Email
Andrew Bruning	abruning@stacktest.us	SES Group 1	6/12/2014	SES	QSTIprogram@gmail.com
		SES Group 2	9/18/2015		
Mike Corrigan	mcorrigan@stacktest.us	SES Group 3	6/12/2015	Ohio-Lumex	andrew.mertz@ohiolumex.com
		EPA Method 30B	1/16/2015*		
Craig Kormylo	ckormylo@stacktest.us	SES Group 1	4/1/2015	SES	QSTIprogram@gmail.com
Matthew Parks	mparks@stacktest.us	SES Group 3	5/12/2011	Ohio-Lumex	andrew.mertz@ohiolumex.com
		EPA Method 30B	1/16/2015*		
*The Source Evaluation Society (SES) Group 1 Exam includes EPA Reference Methods 1, 1A, 2, 2A, 2C, 2D, 2F, 2G, 2H, 3, 3B, 4, 5, 5A, 5B, 5D, 5E, 5F, 5I, 17, 19, 201A and 202. The SES Group 2 Exam includes EPA Reference Methods 1, 2, 3, 4, 3B, 6, 6A, 6B, 7, 7C, 7D, 8, 11, 13A, 13B, 15A, 16A, 19, 26, 26A and 202. The SES Group 3 Exam includes EPA Reference Methods 3A, 6C, 7E, 10, 10B, 20, 25A, 40 CFR Part 60 Performance Specifications 2 – 8, 15 and <u>40 CFR Part 75</u> . Initial 30B training provided by Ohio-Lumex; refresher exam administered by EMCo once every five years.					

Please feel free to contact me with any questions regarding the above.



Matthew Parks
Technical Director